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MEDALS OF THE NATIONAL ACADEMY OF SCIENCES[1,2]

MEDAL PRESENTATIONS: REMARKS BY THE PRESIDENT

ANNUALLY at this time presentation of medals and awards is made by the academy. These are bestowed by formal vote of the academy acting on the recommendations of special committees charged with the responsibility of administering the several trust funds.

Normally the occasion of the bestowal is at a dinner to which the academy invites a number of distinguished men and women to be guests. This year, because of the exigencies of war, the dinner is necessarily confined to the members and the medalists. Although, therefore, the setting for the presentations this evening lacks the brilliance of former occasions, I can assure our medalists that it lacks nothing in the esteem in which the academy holds them and their work.

[1] Meeting at Washington, D. C., April 26 and 27.
[2] The presentation of medals was made at the annual dinner, April 26.

To-night we have five medals to bestow. Two of them are governed by the same trust fund and under its terms are in recognition of distinguished work published in specific years. With some of the medals go monetary awards and diplomas. The medalists will be presented by the chairman or a representative of the trust fund committee which made the nomination to the academy.

The medals will be awarded in the order of establishment of the trust funds.

The first award is that of the Henry Draper Gold Medal to Ira Sprague Bowen, and the citation is: "in recognition of his contributions to astronomical physics; more especially his researches on the spectra and chemical composition of the gaseous nebulae." Dr. S. A. Mitchell will present the medalist.

The Draper Fund was established on April 13, 1883, by deed of gift from Mary Anna Palmer Draper ($10,000 and die), and the deed of establishment provides interest and income to be used for the medal to

be ". . . awarded and presented from time to time, but not oftener than once in two years, by the said National Academy of Sciences to any person in the United States of America or elsewhere—for original investigations in astronomical physics, the results of which shall be made known to the public. . . ." This is the twenty-sixth award of the medal.

The second award is that of the Alexander Agassiz Gold Medal and an accompanying honorarium of $300 to Columbus O'Donnell Iselin, II, and the citation is: "for his studies of the Gulf Stream system, for his leadership in the development of a general program of the physical oceanography of the North Atlantic, and for his distinguished direction of the activities of the Woods Hole Oceanographic Institution, both in peace and in time of war." Dr. Barbour will present the medalist.

The Murray Fund, which established the Agassiz Medal, was established on April 22, 1911, by letter and deed of gift from Sir John Murray of $6,000. In his letter Sir John Murray said, "I enclose you a cheque for $6,000 (£1,233) which sum I trust the National Academy will accept from me, for the purpose of founding an Alexander Agassiz gold medal, to be awarded for original contribution in the science of oceanography to scientific men in any part of the world, whenever and as often as the President and the Council may deem desirable." This presentation is the nineteenth award.

The Daniel Giraud Elliot Medal and award of $200 is to be given for the year 1935 to Edwin H. Colbert, who will be presented by Dr. Gregory, and for the year 1936 to Robert Cushman Murphy, who will be presented by Dr. Harrison. The Daniel Giraud Elliot Fund was established on April 17, 1917, by gift of $8,000 from Miss Margaret Henderson Elliot to carry out a testamentary provision in the will of her father, Daniel Giraud Elliot; the deed of gift stipulates: "One such medal and diploma shall be given each year . . . with any unexpended balance of income for the year . . . to the author of such paper, essay, or other work upon some branch of zoology or paleontology published during the year . . . etc." Award is made to Dr. Colbert in recognition of the high merits of his work, "Siwalik Mammals in the American Museum of Natural History," published in the *Transactions* of the American Philosophical Society in 1935. This presentation is the eighteenth award. The nineteenth award is made to Dr. Murphy in recognition of the high merits of his work, "Oceanic Birds of South America," published in two volumes in 1936.

The final award is that of the John J. Carty Medal and award for the advancement of science, for which the honorarium is $4,000 for this year to Edwin Grant Conklin. The citation is: "Zoologist, Cytologist and Embryologist; Philosopher, Teacher and Scientist; Student of life and of growth from lowliest beginnings to highest consummation." The medalist, who is the fourth to receive the award, will be presented by Dr. O. E. Buckley. The Carty Fund was established on November 13, 1930, by deed of gift from the American Telephone and Telegraph Company ($25,000) in recognition of the distinguished achievements of John J. Carty. The deed of gift stipulates a gold medal and monetary award ". . . for specific accomplishment in some field of science or for general service in the advancement of fundamental and for applied science." The award is to be bestowed without limitation as to race, nationality or creed of the individual sought to be honored, and the method of selecting a candidate is to be wholly at the discretion of the academy.

The medal and award are to be presented not oftener than once in two years and the award is to be substantially the net accumulated income from the fund since the time of the last award, after deducting a nominal cost of administration and the cost of the gold medal and one or more bronze replicas.

In addition to the fund, the dies for the medal and the cost of the first medal were presented to the academy by the eleven officers of the American Telephone and Telegraph Company associated with General Carty in the executive management of the Bell System.

My participation in the presentation of this particular medal to this particular recipient gives me great personal satisfaction. Both the man in whose honor the medal was established and to-night's recipient attained great eminence in science and, as men, each was a great admirer of the other, and in the thinking of each was something derived from his friend. For many years, I have been an admirer of both men.

For more than a quarter of a century, General Carty was my leader and my friend. From him I learned more of science and the ways of men than from all others together. It was my pleasure to have part in establishing the medal and award in his honor. The terms of the deed of gift are in consonance with both his catholicity of view as to all fields of science and all manner of men. It reflects likewise his unbounded confidence in the wisdom of the academy in administrating a trust through the years.

Carty was alive when the medal was established and the first draft of the deed of gift was submitted to him. He objected to it because it contained what he thought was a reflection of his known views. He insisted that the academy be given complete freedom in the years ahead to exercise its judgment unhampered in any way by the views or beliefs of a preceding generation.

I strongly suspect that in this he was influenced by his contacts with Dr. Conklin. I know that he would have derived great satisfaction in this award to his friend.

FRANK B. JEWETT

PRESENTATION OF THE HENRY DRAPER MEDAL FOR 1942 TO IRA SPRAGUE BOWEN[3]

MORE than three quarters of a century ago, Huggins, a former Draper medalist, found that the spectra of certain nebulae were composed of sharp isolated bright lines, thus proving that their luminous material is a glowing rarefied gas. Some of the lines were recognized as those of hydrogen, and later others were identified as due to helium and ionized carbon, oxygen and nitrogen, but nearly half of the nebular radiations, including the two strong green lines, could not be matched in any terrestrial source. These mysterious radiations were believed to indicate the presence in the gaseous nebulae of an unknown element "nebulium" and for more than sixty years the nature of "nebulium" remained one of the outstanding problems of physical astronomy with which the ablest spectroscopist had struggled and had failed. It was solved not by an astronomer but by a physicist, Professor Ira Sprague Bowen, of the California Institute of Technology.

Dr. Bowen's dramatic discovery of the nature of "nebulium" was the result of his brilliant analysis based as modern atomic theory, in which two factors contributed to his success. The first of these was the recognition by him that under the condition of extremely low density obtaining in the gaseous nebulae, radiation of energy could take place through transitions between metastable states. For these the mean life of the excited state is so long that even in the most rarefied laboratory sources, the energy is transferred to another atom by collision and no radiation occurs. The second contributing factor was that his laboratory investigations in spectroscopy carried on in collaboration with Millikan furnished the data which enabled him to determine the energy states for certain of the lighter elements known to be present in the nebulae. He found that the two strong green radiations and one in the blue could be accounted for by transitions between metastable states in doubly ionized oxygen. The familiar pair in the ultraviolet and a line in the red had a like origin in ionized oxygen while the strong red pair was due to similar transitions in ionized nitrogen. Thus "nebulium," the mystery of half a century, turned out to be the two elements forming the chief constituents of the air we breathe.

This initial success with the origin of the chief nebular lines was followed immediately by his identification of a number of fainter ones which had been recorded in the spectra of these objects. Later when opportunity offered, Dr. Bowen went to the Lick Observatory as Morrison research associate where he undertook a search for still fainter radiations emitted by the nebulae. Largely as the results of ingenious methods introduced by him in the observing technique, he was able to record the faintest lines obtainable with the very efficient equipment selected for this problem. The investigation was signally successful and not only revealed the presence in the nebulae of several elements, in particular iron, magnesium, potassium and calcium, which had not been known to exist in them, but indicated that the chemical composition of the gaseous nebulae does not differ greatly from that of the sun and the stars, a result of great cosmological importance.

The researches of Professor Bowen have not only greatly enriched our knowledge of the chemical constitution of the nebulae, but they have provided the answers to many enigmas concerning the physical processes involved in the emission of their light. He has given us most conclusive explanations of the presence or absence of certain radiations in their spectra and in particular the behavior of different lines emitted in the gaseous envelopes of very high temperature stars, bringing to these problems that brilliant and logical analysis characteristic of all his work. His spectroscopic investigations in the laboratory, moreover, have furnished the data not alone for his own researches on the nebulae but have been utilized by others in the solution of the many spectroscopic problems in the broader field of astrophysics. We are, therefore, indebted to him for some of the most important contributions to astronomical physics in recent times.

In recognition of these remarkable achievements your committee has unanimously recommended the award of the Draper Medal for 1942 to Professor Ira Sprague Bowen. The academy may justly be proud to count him among its members and to honor him by the bestowal of this award.

J. H. MOORE

[3] Read by Dr. S. A. Mitchell, in the absence of Dr. Moore.

PRESENTATION OF THE AGASSIZ MEDAL FOR THE YEAR 1942, WITH ACCOMPANYING HONORARIUM OF $300, TO COLUMBUS O'DONNELL ISELIN, II.

I AM going to be a bit reminiscent this evening and recall that over forty years ago when I went up the steps of the Agassiz Museum for the first time, a tall stooped figure had just preceded me, the smart brougham from which he had emerged was in the act of driving off. I followed that figure up the stairway and saw it enter a door marked "A. Agassiz" in bold

letters. As he went in he turned a little sign from "out" to "in." I turn that same sign when I remember to do so, but I often forget; he never did. I naturally wondered what manner of man this was. I soon found out that the graduate students at that time packed into the museum building held him in mortal dread. Rumor had it that some one once carrying a leaky pail of water with living Necturi for experimental purposes from the cellar to the research laboratory on the fifth floor had gone up the stairs just ahead of him. Being the soul of precision and neatness he began to follow the streak of dirty water and he followed it to the desk of the unfortunate student, to whom he administered a most terrific lecture on the evils of untidiness. The details of this persisted and no doubt grew as the tale was told over and over again. In those days long ago there was no love lost between the museum staff and the professors and instructors in the laboratory belonging to the faculty of arts and sciences. All these were then crowded together in the same building. They have all learned better sense now and realize how the work of each one interdigitates with that of all the others. So at the time of which I speak Mr. Agassiz was a mysterious figure, held in what we should think of to-day as rather ridiculous awe.

A few among us who were interested in the museum soon learned of the wonderful work which he had done in his younger years in invertebrate embryology; his masterly handling of the taxonomy of that most difficult group, the Echini; his pioneer work in the exploration of the deep sea; three careers, each of which would have won him lasting fame, to say nothing of his management of the Calumet and Hekla Mining Company, which provided the funds so generously spent by him in many ways and especially on the unequaled series of illustrated Memoirs, the like of which no institution in America has ever produced.

Unfortunately during the latter years of his life he spent, wasted as we know now, years on the study of coral reefs, years which he might far better have devoted to subjects which he was more competent to work upon. While he describes reefs beyond number, he was unable to draw any generalizations and the data which he gathered have not been very useful to the geologists, although Dr. Stanley Gardiner has made some important deductions from the bottom samples which he gathered.

I early determined to know this man and found him simple, kind and friendly. He was much interested in the boyish trip which some friends of mine and I hatched up for the summer of our sophomore year in the Bahamas, using a sponging schooner to dredge from. He was obviously sincerely interested in what we found, and I remember one sponge over which he was really excited.

I found that regularly at ten o'clock each evening that he was in Cambridge, he would go to the Holly Tree at Harvard Square, famous for its beautifully poached eggs. He would eat two of these, drink a glass of beer and then walk back to his house on Quincy Street. I made bold to meet him there quite casually and after a while often walked home with him. This same habit of taking walks at night led to an amusing incident in Berlin, where Mr. Agassiz had been called to be knighted by the German Emperor with the Order pour le Merite, a distinction rarely accorded to foreigners. One evening just after the great event, it was foggy and he was crossing the river which flows through Berlin, walking along the narrow footpath of the bridge. He fetched up in front of a towering figure in the familiar Feldtgrau uniform. Naturally the officer made no move; neither by the same token did Mr. Agassiz, who was nothing if not hot-tempered and impetuous. After some slight hesitation he reached forward and drew the German officer's sword from its scabbard and dropped it into the river. The effect was exactly the opposite to what he had expected. The officer, who had sworn to defend his sword with his life-blood if necessary, was not as infuriated as he was terror-stricken and dismayed, and before long quite characteristically Mr. Agassiz's heart softened and he promised that as soon as daylight came every possible means should be taken to recover the sword. This naturally was done to the officer's everlasting gratitude.

But I can not ramble on this way forever. I simply wanted to point out, as one of a number of those who remember him, but who are inevitably growing fewer, the sort of man whom Sir John Murray wished to commemorate when this award was established. I also wish to put on record the fact that I can think of no one who could stand as recipient and be more utterly satisfactory to Mr. Agassiz as him whom we honor now. Columbus Iselin began as a young man to explore the deep sea from his own *Atlantis*, and I remember the joy and delight with which Henry Bigelow and I gloated over his first catches of beautifully preserved deep-sea fishes and invertebrates. From those days forward Columbus has proved himself to be a competent investigator. Oh no! more than that, an inspired investigator and an excellent teacher, a painstaking and effective executive, and one whose researches into the dynamics and the circulation of the waters of the ocean and especially of the Gulf Stream, have put him in the forefront of oceanographers of the day. Moreover, he has administered the activities of the Woods Hole Oceanographical Institute with singular distinction, both during peace and during war; this also considering that he followed a predecessor who set a mighty high standard for any one who came after him.

It is therefore a rare distinction for me as a member of the committee which has made this award to ask the president in the name of the academy to hand the Agassiz Medal to Columbus O'Donnell Iselin. I only wish that Mr. Agassiz had lived to know him.

THOMAS BARBOUR

PRESENTATION OF THE DANIEL GIRAUD ELLIOT MEDAL FOR 1935, WITH ACCOMPANYING HONORARIUM OF $200, TO EDWIN H. COLBERT

THE award to Edwin H. Colbert for his "Siwalik Mammals in the American Museum of Natural History" (*Transactions* of the American Philosophical Society, 1935, quarto, x + 401 pp., 198 figures in text, 1 folding map) seems especially timely and appropriate, because just a century earlier Cautley and Falconer published the first of their important contributions on the fossil mammals of India. Since then the field has been ably developed by their successors, especially Lydekker, Pilgrim, Matthew and now Colbert. The latter, after giving an excellent summary and analysis of his predecessors' results, has brought in a wealth of new and significant observations of his own.

Although this work is written in English, the technical portions, albeit through no fault of the author, would be hardly more intelligible to the English-speaking world than Chinese, except for the handful of students who have mastered the technical language of paleontology. This branch of science has inherited a double load of technical words, first from geology, and second from anatomy, besides contributing an enormous and rapidly growing vocabulary of its own. But however technical the author was compelled to be in the descriptive portions of his text, he has succeeded in achieving great clarity in the statement of his more general results, which are of wide interest to students both of mammalian evolution and of intercontinental exchange of faunal elements.

In summarizing the work of his predecessors, the author notes that: "Lithologically the origin of the (Siwalik) series is probably simple, representing increasingly coarse river detritus brought down from a rapidly rising mountain mass. Moreover, there are no great secondary changes to be found in the Siwalik rocks, evidences of automorphism and glaciation being absent. The factor of predominant importance is that of erosion and deposition by rapidly flowing rivers." He sets forth fully the accurate records as to locality and stratigraphic levels which were kept by Barnum Brown when the latter made his collection of fossil mammals for the American Museum in 1922. Brown's work in this field was amazingly extensive and productive, especially in view of the great difficulties of collecting in this super-torrid region.

The main part of Colbert's memoir deals with the description of the fossil mammals, the classification and phylogeny of many of the mammalian families, the migrations of certain mammals to and from India during late Tertiary and Quaternary times.

Among the most remarkable mammals dealt with was *Dissopsalis,* a somewhat wolflike placental carnivore with a remarkably small brain—the last survivor of the Eocene and Oligocene creodonts.

In the section on the horses Colbert's measurements and graphs confirm Matthew's conclusion that the two Siwalik "species" of *Hipparion* grade into each other. He further shows that with regard to their molar patterns these forms were definitely more advanced than the American *Hipparion mohavense* Merriam and *H. gratum* Osborn. From this fact and from the complete absence in the known record in Europe of ancestral *Hipparions* of earlier date, Colbert favors the view that these forms originated in North America and spread to India during the lower Pliocene.

The ten species of Siwalik rhinoceroses are distributed under five genera, of which *Gaindatherium* Colbert is more primitive in many features than the existing *Rhinoceros indicus.* It is also intermediate between the latter and the very primitive and older *Caenopus.* Colbert applies and extends D'Arcy Thompson's method by projecting the drawings of several rhinoceros skulls against a grid of coordinates; in a sequence of four rhinoceros skulls the coordinates become progressively distorted in several directions, indicating differential emphasis of certain features.

One of the most notable parts of the memoir deals with the fossil pigs of India, which branched into fifteen genera and numerous species. Colbert divides them into six groups and traces several phyletic lines through the lower, middle and upper Siwaliks. In one of them, *Conohyus,* the posterior premolars developed great conical crowns for smashing and cutting the food. In another, *Listriodon,* each molar bore two cross-crests and thus convergently resembled a tapir's molars. In still another, *Sus falconeri,* the skull is already highly peculiar and needs only the final stage to complete its transformation into that of the African wart hog (*Phacochoerus africanus*).

In describing the fossil Indian hippopotami Colbert quotes the remarkable suggestion of C. W. Andrews that the hippopotami, usually supposed to be related to the pigs, may have been derived from some of the anthracotheres, especially the Siwalik *Merycopotamus.* Colbert gives a thorough analysis and comes to a conservative conclusion but leaves a strong case for the reality of Andrews's interpretation of the evidence.

The descriptive section ends with an excellent analysis of the twenty genera and numerous species of fossil giraffes centering in the Siwaliks. Colbert divides them into three main series: The first and

most primitive being represented by the living okapi of the Belgian Congo, the second by the typical giraffes, the third by such massive giants as *Sivatherium*, whose skull bore huge branching bony "horns."

In the closing analysis on the migration of certain mammals to and from the Siwaliks we see India as at the crossroads, exchanging mammals with Europe and Africa on the one hand and with Asia and North America on the other.

In view of the merits of this work mentioned above, as well as others, the committee has unanimously recommended the award of the Daniel Giraud Elliot medal and honorarium for 1935 to Edwin H. Colbert.

WILLIAM K. GREGORY

PRESENTATION OF THE DANIEL GIRAUD ELLIOT MEDAL FOR 1936, WITH ACCOMPANYING HONORARIUM OF $200, TO ROBERT CUSHMAN MURPHY[4]

FEW writers have had a more prolonged and varied preparation for their task than Dr. Robert Cushman Murphy as author of the "Oceanic Birds of South America." Soon after graduating from Brown, Dr. Murphy shipped aboard the whaling brig *Daisy* on a voyage of nearly a year's duration in the South Atlantic. For the longer part of this period he was associated with birds of the high seas, pulling an oar with the best of the shearwaters and other pelagic species; but for four months he lived on the island of South Georgia. There he obtained the rudiments of a course in South American littoral ornithology. Penguins, albatrosses and other species little known on their breeding grounds were his teachers, but the day was to follow when he would become their monographer.

Several years later, Dr. Murphy passed six months among the bird islands of the Humboldt Current off the coast of Peru. Here, in the world's greatest demonstration of certain phases of bird-life, his education in the ways of marine birds and the factors governing their distribution were still further advanced. In 1924 he returned to this region and extended his studies to the coast of Ecuador.

In these three productive expeditions, Murphy found the field in ornithology in which he has distinguished himself, and when opportunity offered for the formal pursuit of his researches he was equipped to embrace it. Meanwhile, the American Museum of Natural History, under the patronage of Messrs. Brewster and Sanford, commissioned R. H. Beck to collect the marine and littoral birds of South America from Peru to Pará, including Cape Horn and the Falkland Islands. This master of his profession was in the field for four-and-a-half years securing 7,853 specimens, each one a potential source of original information. Murphy was the one man qualified by experience, training, and desire to interpret this collection. Fortunately, he was now on the American Museum's staff. With most of the species represented, he was familiar in life; and he had visited a large part of the area whence they came. Thus his field-studies, added to Beck's collections, made the ideal laboratory combination. With it was included a thorough review of all pertinent literature. Several years were required to digest the whole and present the resulting facts and conclusions in two eminently readable volumes of objective and subjective ornithology.

To the systematic treatment of all the forms concerned, there was added an exposition of Murphy's discovery that oceanic birds are subject to the same kind of environmental control as seals, sea-turtles and even fish. The part played in distribution by the temperature of water as well as air, the influence of wind and of currents and the effects of insular isolation are also considered. Full biographies, when available, are given with each species, and long-standing biologic problems like that presented by the confusing relations of the steamer ducks are satisfactorily treated. All this, and more, is set forth in the 1,245 quarto pages entitled "Oceanic Birds of South America," forming a work of such high merit that, *Mr. President:* The committee has recommended the award by the Academy of the Elliot Medal for 1936 to Robert Cushman Murphy as its author.

FRANK M. CHAPMAN

PRESENTATION OF THE JOHN J. CARTY MEDAL AND AWARD (MONETARY AWARD $4,000) TO EDWIN GRANT CONKLIN

THE Committee for the Award of the John J. Carty Medal has had an easy and a pleasant task to perform, for once the name of Conklin was suggested as recipient, so appropriate was his selection that there scarce could be a competitor.

In the citation which has been read are indicated many ways in which Edwin Grant Conklin merits this medal and award, but there is another and unique way in which Conklin qualifies. I refer to Carty's friendship and admiration for Conklin which all Carty's close associates attest, and to the influence of Conklin's philosophy on Carty's thinking as indicated by his writings.

Conklin had pointed out that man's future development lay not in the evolution of man as an individual but in the evolution of society—the building of an harmonious body out of cooperating human elements, with man adding to his own power the forces of nature. Carty saw in the telephone system of his

[4] Read by Dr. Ross G. Harrison, in the absence of Dr. Chapman.

creation the nerve system of that society—his telephone wires and radio channels were the nerves to provide communication among the specialized human elements of the peaceful and efficient social organization yet to be evolved.

In this connection and because of its timeliness, I think you will be interested in hearing a quotation from an unpublished address of John J. Carty in 1923. After referring to Conklin, Carty said:

> We are rapidly constructing a wire and radio system of world communications which is destined to become the nervous system of that vast organism or pseudo-organism known as human society. Whether this organism shall be a sane and peaceful one, or whether we are providing it with a nervous system in preparation for a universal brain storm, requires our most serious consideration.
>
> The progress of science is now so rapid that in less than another hundred years man will be endowed with powers of destruction transcending anything heretofore known. Even half a century hence, communications and transportation may be so far advanced that all of the nations of the earth could be drawn into a war at the end of which the whole world might be in chaos.
>
> That such a catastrophe is possible I firmly believe, but that it can be averted I also firmly believe. This can not be done by slowing down our progress in the application of science to material things; but on the contrary we must accelerate our progress in all the physical sciences, for all of the knowledge thus gained will be required in solving the problem presented by man himself as the fundamental unit of that gregarious organism, human society.[1]

Mr. President: The committee for which I speak is happy to have had the opportunity of making a report so enthusiastically accepted by this academy.

O. E. BUCKLEY

OBITUARY

MARY JANE RATHBUN

DR. MARY JANE RATHBUN, honorary associate in zoology at the U. S. National Museum since November, 1915, died at her home in Washington, D. C., on April 4. Funeral services were held in Washington at the home of her nephew, and burial was at her birthplace, Buffalo, N. Y.

Born in Buffalo on June 11, 1860, Miss Rathbun was educated in the schools of that city, and thereafter devoted a long life of service to the Smithsonian Institution and the U. S. National Museum.

Her brother, Richard Rathbun, later to become assistant secretary of the Smithsonian Institution and director of the National Museum, was, in the early 1870's, already launched on a scientific career which had grown out of his interest in fossil animals found in his father's stone quarries in Buffalo. In the summer of 1881, when he was scientific assistant in the U. S. Fish Commission, his sister accompanied him on one of his annual trips to the commission's summer laboratory at Woods Hole, Massachusetts. There her own interest in biological research was stimulated, and she continued to visit Woods Hole for the next three summers. So great was her interest that she worked for the Fish Commission from 1881 to 1884 without compensation. In 1884 she obtained a position as clerk in the Fish Commission, which she held until 1887, when she was appointed by Secretary Spencer F. Baird, of the Smithsonian Institution, to a position as copyist in the Division of Marine Invertebrates of the National Museum. Later she became aid, then assistant curator of this division. After her resignation in 1914, she was appointed honorary associate in zoology, which title she held until her death.

Miss Rathbun worked for many years alone and unaided to build up the Division of Marine Invertebrates to its present high standard of excellence. She instituted a record system upon which others have never been able to improve. It not only is in use in the division to this day, but has been studied and adopted by other divisions of the museum. She also established a systematic catalogue of the thousands of specimens of marine invertebrates handled by the division, whose files contain hundreds of catalogue cards made out by her in longhand during the many years before a typist was available for this work. The division, as it is constituted and operated to-day, continues to rest upon the solid foundation that she built for it.

Because of her enterprise, the collections and correspondence of the division grew to such proportions that it became imperative for her to have assistance in handling them. When she asked for such an assistant, however, she was told that the museum funds would not permit the appointment of another person. It was then that she made the decision which forever after endeared her to her colleagues, and particularly to the man who benefited by her action. Without hesitation, on December 31, 1914, she resigned her position, in order that her salary could be used for paying an assistant. The assistant for whom she thus made place was Dr. Waldo L. Schmitt, who later became curator of the division. He declares that but for this act of sacrifice he might never have embarked upon the career to which he has devoted his life and which has only recently led to his designation as head curator of the Department of Biology at the museum. He deeply regrets that his absence from the country

[1] Address on "World Communications," at The University Club, New York, February 10, 1923.

at this time made it impossible for him to prepare this obituary notice.

Though now resigned from the museum payroll, Miss Rathbun went to work as usual, and continued to serve full time for twenty-five years thereafter. Thus her Government service ended as it began—with devotion to science and without compensation.

Her own special field of interest was the Crustacea, particularly the crabs, both recent and fossil. Her bibliography on these animals embraces 158 titles. Perhaps her most important and best-known works are her four large monographs on the grapsoid, spider, cancroid and oxystomatous crabs of America, published as bulletins of the U. S. National Museum between 1918 and 1937. In 1917 the George Washington University conferred upon her the degree of doctor of philosophy in recognition of her work on the grapsoid crabs.

Miss Rathbun was interested in a number of charities, but her assistance and contributions to worthy enterprises were given quietly and not much was known about them by her colleagues. It is known, however, that for some years after the last war, when life was very difficult in Austria, she contributed to the support of the small daughter of an Austrian scientist who had long been one of her correspondents. It is only to be hoped that her services to that child, who is now a young woman in Nazi Germany, were not in vain.

Aside from her interest in her work, which took up the greater part of her time, Miss Rathbun was interested in both music and the theater. She was a familiar figure at the concerts given in Washington by the Philadelphia and Boston Orchestras until about four years ago, when her health failed to such an extent that she was no longer able to go out.

To those who knew her and worked with her, Miss Rathbun was a staunch friend, an able counselor and a willing guide. With her passing the museum and science have lost a friend whose loyalty and devotion can not soon be duplicated.

LUCILE MCCAIN

U. S. NATIONAL MUSEUM

RECENT DEATHS

DR. HERBERT E. HAWKES, professor of mathematics at Columbia University and dean of the college, died on May 4 at the age of seventy years.

DR. ELLWOOD B. SPEAR, since 1928 manager and director of research of the Vultex Chemical Company, previously a member of the faculty at the Massachusetts Institute of Technology, died on May 1. He was sixty-eight years old.

DR. W. H. A. LEUKEL, agronomist with the Florida Agricultural Experiment Station for the past seventeen years, died on April 27. He is known for his work on Florida grasses and crops.

SCIENTIFIC EVENTS

MUSEUM ATTENDANCE AND THE WAR

THE Museums Council of New York City has issued to its members a statement giving figures of attendance at the museums, botanic garden, zoological park and the New York Public Library of the city for the calendar year 1942, with comparisons for 1941. The accompanying table gives these figures and the percentages of increase and decrease of attendance for eight (out of nineteen reported on) of the more largely attended institutions. It is interesting to note that the only institutions that show increased attendance in 1942 are two private institutions that charge 25 cents admission. The semi-public institutions, supported in part from the tax budget of the city and in part from private funds, are open free to the public daily.

The report as issued attempts no explanation of the falling off of attendance, but it seems reasonable to infer that the decrease was due to one or more causes growing out of the war. The order of the Board of Education of the city prohibiting public-school classes from visiting any outside institution for instruction for the larger part of the year would account for a part of the loss. The attendance of classes in normal times adds something, of course, to the figure of total museum attendance. The institutions in the table are arranged in the order of percentage of gain or loss of attendance.

ATTENDANCE AT NEW YORK CITY MUSEUMS, 1941 AND 1942

	Attendance 1941	Attendance 1942	Change	Per cent. of change
Increase:				
1. N. Y. Museum of Science and Industry	360,771	414,410	53,639	+15
2. Museum of Modern Art	274,070	279,417	5,347	+ 2
Decrease:				
1. N. Y. Zoological Park	3,320,313	2,319,052	1,001,261	-32
2. Brooklyn Museum	523,856	381,772	142,084	-27
3. New York Public Library	3,331,309	2,772,419	558,890	-17
4. American Museum of Natural History	1,618,765	1,388,561	230,204	-14
5. Metropolitan Museum of Art	1,028,950	896,466	123,484	-13
6. Brooklyn Botanic Garden	1,753,381	1,660,046	93,335	- 5

THE AMERICAN COORDINATING COMMITTEE ON CORROSION

THE fifth annual meeting of the American Coordinating Committee on Corrosion was held on April 10 in Pittsburgh, coincident with a one-day symposium on corrosion problems sponsored by the Corrosion Division of the Electrochemical Society, meeting in Pittsburgh on April 8, 9 and 10. Dr. R. B. Mears was elected committee chairman for 1943–44, F. L. LaQue was named vice-chairman and Dr. G. H. Young was re-elected secretary-treasurer. The headquarters are at the Mellon Institute in Pittsburgh.

The committee was organized five years ago to coordinate research activities in this field, and is patterned after similar organizations abroad. As its first contribution, it undertook to survey existing corrosion investigations in this country. Information report forms were submitted to some 600 individuals and companies, through the executive offices of the member organizations of the committee. From the data thus accumulated there was issued in 1940 a confidential Directory of Corrosion Investigators and a classified list of subjects, which was sent to all persons officially listed in the directory. This directory has since been expanded to include additional investigators and to broaden its subject classification. A new revision is planned for 1943.

The committee is at present composed of official delegates from the American Foundrymen's Association, the American Gas Association, the American Institute of Chemical Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society for Metals, the American Society of Refrigerating Engineers, the American Society for Testing Materials, the American Water Works Association, the American Welding Society, the Armour Research Foundation, the Battelle Memorial Institute, the Electrochemical Society, the Mellon Institute of Industrial Research, the National Bureau of Standards, the National District Heating Association, the National Research Council and the Society of Automotive Engineers. In addition, the American Association for the Advancement of Science and the Canadian National Research Council were elected to membership.

THE BROOKLYN BOTANIC GARDEN

THE thirty-second annual report of the Brooklyn Botanic Garden, just published, records the fact that almost every activity of the garden during 1942 has been determined or modified by the attack on Pearl Harbor and the events that followed. Several pages of the report are devoted to the wartime activities of the garden and its many cooperations with national, state and local agencies. These include extensive victory garden work, with classes and lectures, the maintenance of a model victory garden, wide-spread service through the bureau of public information and the publication and distribution of leaflets on vegetable gardening. More than 125 trees and shrubs and quantities of herbaceous material have been contributed for planting at army camps, nearly 230 books were contributed for the libraries maintained by the United Service Organizations and other agencies, and nearly $5,000 of war stamps and bonds have been purchased by 60 employees. Members of the Kings County War Savings Staff were given permits to sell stamps and bonds in the garden, and the Office of Civilian Defense, with a permit for a table in the garden, enrolled volunteers in twelve different war services, including blood donors, nurses' aids, etc.

Flowers were sent weekly to the Naval Hospital near the Brooklyn Navy Yard; Camp Upton, L. I., was supplied with more than 2,000 ornamental plants for the camp gardens, ornamental plants were supplied to the Service Club Library at Fort Hamilton, about two tons of scrap metal were turned in, and the Office of War Information was given information on the proposed utilization for food of native wild plants of various European countries.

The report includes records of progress in investigation in plant diseases, plant breeding and other aspects of botany, the distribution to more than 600 schools, in every borough of Greater New York, of nearly 1,316,000 packets of seeds to children for planting in school and home gardens, and the attendance of more than 59,500 at classes and lectures during the year, with a registration of nearly 1,300 adults. The registered attendance at the garden for the year 1942 was 1,660,046.

THE RADCLIFFE CHAPTER OF THE SOCIETY OF THE SIGMA XI

THE establishment of a Radcliffe Chapter of the Society of the Sigma Xi has met with some delay because of the unique conditions prevalent in the college. Although its administration is separate from that of Harvard University, all instructors and professors are members of the Harvard faculty and many are members of the Harvard Chapter.

Fifty-nine science instructors and professors teaching at both institutions signed the petition for the chapter on March 24, 1942. It was granted at the forty-third annual convention of the national organization on December 29. Formal installation at Radcliffe College took place on April 15.

Professor Harlow Shapley, national president, and Professor Edward Ellery, past-president and president at the time the petition was granted, were the installing officers. The ceremonies were less formal than is usual on such occasions. Following a tea in Byerly Hall, the science building, the petitioners and

delegates assembled in the Ghirlandajo Room of Agassiz House, where the installing officers spoke briefly on the significance of the society and its major activities, especially of its national lectureships and publications.

Officers were elected as follows: *President,* Dr. Cecilia Payne-Gaposchkin; *Vice-president,* Dr. Elizabeth Deichmann; *Member of the Executive Committee,* Dr. Ytte Muus, and *Secretary-Treasurer,* Dr. Dorrit Hoffleit, all members of the Harvard Chapter. Professors F. M. Carpenter, Grinnell Jones, E. A. Hooton, H. R. Mimno and D. S. Whittlesey were elected members of the committee on membership of the Radcliffe Chapter. The charter was then presented by National President Shapley to Chapter President Payne-Gaposchkin.

In the evening over a hundred members, delegates and guests of the chapter, including Radcliffe graduate students in scientific fields, were entertained at the college. Dr. F. L. Hisaw acted as toastmaster. Dr. Shapley pointed out that this year marks several important scientific anniversaries—the one hundredth anniversary of Harvard College Observatory, the two hundredth of the birth of Thomas Jefferson, the three hundredth of Newton's and the four hundredth of the death of Copernicus. He spoke mainly on various activities for the promotion of science.

The principal address of the evening was given by Dr. Cecilia Payne-Gaposchkin, who spoke on "The Scholar and the World."

DORRIT HOFFLEIT,
Secretary-Treasurer

POSITIONS WITH THE NAVY

THE Navy needs capable men for staff duties in the administration of occupied areas of foreign lands. Candidates with a background of education and experience in government administration may qualify.

Foreign travel, particularly in the Far East and Southwest Pacific region, is desirable; also a knowledge of the customs, language and character of the people in these areas. Applicants with similar experience and knowledge of other foreign areas will be considered if they meet one or more of the following qualifications:

Administrative experience of an important nature, domestic or foreign, involving government, business, foundations, schools of public administration, etc.

Educational experience in State and Federal governments, university administrators; also teachers in fields of geography, economic and international relations.

Engineering experience: construction of public works, shipping, public utilities, transportation, etc.

Legal training and experience of an important nature indicated by relative importance of position in profession or related field, preferably public service.

Candidates must be in good physical condition and be capable of absorbing intensive instruction in a one-year course in government. Commissions in the U. S. Naval Reserve will be granted immediately and applicants who qualify will be on an active duty status. All educational expenses will be paid by the Navy. Service of these officers will extend beyond the expiration of the war.

Qualified candidates should apply to the nearest Naval Office of Officer Procurement. These offices are located in all major cities.

THE AMERICAN CHEMICAL SOCIETY AND THE KILGORE BILL

IN accordance with information received from the American Chemical Society the directors of the society oppose the establishment of an Office of War Mobilization as proposed in Senator Kilgore's bill. Dr. Charles L. Parsons, secretary of the society, reports that

> In the opinion of the directors there is no necessity for the enactment of such legislation now. Their objections can be summarized briefly by stating that these bills confer totalitarian powers that should be entrusted to no human being, and require an omniscience for their intelligent execution which is not to be found on this earth.
>
> The directors believe that the enactment of these bills into law at this time would serve no good purpose in so far as the mobilization of technical resources in the field of chemistry is concerned. The Government now has at its command every resource in the fields of chemistry and chemical engineering.

In support of the position taken by the directors, Dr. Parsons points out that the membership of the society, which includes practically all the leading chemists and chemical engineers of the country organized into 101 local sections, varying in size from 30 to 2,500 each, is solidly behind the war effort. Its publications are described as "a complete key to all that is new in chemical discovery and development." They go to all agencies of the Government engaged in the war effort and in addition they go to all war plants engaged in the war effort which in any way deal with the field of chemistry, and they go to practically all the research laboratories in the United States as well as to all educational institutions with chemical departments.

The chief of the Chemicals and Allied Products Branch of the War Production Board is reported to have stated that "without the publications of the society, the laboratories of our colleges, of our Government and of our industries could not efficiently function. These journals are a contribution to the

success of the war which must not be handicapped or retarded in any way. . . . Without them the technical staffs of the Chemical Warfare Service would be most seriously handicapped in their developmental work."

Senate Bill 607 proposes to set up the following offices: (1) Office of Production and Supply, (2) Office of Manpower Supply, (3) Office of Scientific and Technological Mobilization, and (4) Office of Economic Stabilization. This bill carries an appropriation of $400,000,000 and provides for a director of the Office of War Mobilization and four administrators appointed by the director with the approval of the President, one administrator for each of the four offices the bill would create.

SCIENTIFIC NOTES AND NEWS

THE degree of doctor of science was conferred by the University of Rochester at its ninety-third commencement exercise on May 2 on Dr. Stanhope Bayne-Jones, professor of bacteriology and dean of the School of Medicine of Yale University, on leave as a colonel in the Army Medical Corps, and on Dr. Roger Adams, head of the department of chemistry of the University of Illinois, one of the chemists in charge of chemical warfare research.

AT the ninetieth commencement of the University of Wisconsin on May 29 an honorary degree will be conferred on Dr. Henry F. Helmholz, professor of pediatrics at the Mayo Foundation of the University of Minnesota, head of the section of pediatrics of the Mayo Clinic at Rochester, Minn.

DR. THOMAS E. FRENCH, emeritus professor of engineering drawing at the Ohio State University, has been awarded the Lamme Medal for meritorious achievement in engineering. This medal, going each year to an Ohio State alumnus who has distinguished himself in engineering, is named for its donor, the late Benjamin G. Lamme. Dr. French will receive the award at commencement on June 11.

SIR HENRY HALLETT DALE, president of the Royal Society, has been awarded the Harben Gold Medal of the Royal Institute of Public Health and Hygiene, London.

DR. CLARENCE A. HORN, of Albright College, was elected president of the Pennsylvania Academy of Science at the seventeenth annual meeting in Harrisburg on April 2 and 3. He succeeds Charles E. Mohr, director of education of the Philadelphia Academy of Natural Sciences. Dr. Homer C. Will, Juniata College, was chosen president-elect. Vice-presidents elected were Dr. Bradford Willard, Lehigh University, and Dr. LeRoy K. Henry, the Carnegie Museum. Dr. Edwin G. Conklin, president of the American Philosophical Society, and Dr. C. E. McClung, emeritus professor of zoology of the University of Pennsylvania, acting chairman of the department of zoology of Swarthmore College, were elected honorary members.

THE University of Rochester Chapter of Sigma Xi has elected Dr. E. F. Adolph, *President,* and Dr. R. W. Helmkamp, *Vice-president.* Drs. S. C. Bishop and E. A. Culler have been elected members of the *Executive Committee,* and Drs. R. Goodwin and F. Paul of the *Nominating Committee.* The other officers of the society are Drs. K. E. Mason and M. Huggins, *Executive Committee;* Drs. S. C. Madden, F. L. Haven, H. Gardner and H. Scherp, *Nominating Committee,* and Dr. Charles D. Kochakian, *Secretary-Treasurer.*

PROFESSOR VINCENT DU VIGNEAUD, head of the department of biochemistry of Cornell University Medical College, has been elected chairman of the New York Section of the American Chemical Society. He succeeds Dr. Charles N. Frey, director of research of the Fleischmann Laboratory of Standard Brands, Inc. Dr. Beverly L. Clarke, head of the analytical department of Bell Telephone Laboratories, Inc., has been chosen chairman-elect. Dr. Clarke will serve as vice-chairman until July 1, 1944, when he automatically becomes chairman. At the same meeting Professor Peter Debye, of Cornell University, delivered an address on "Reaction Rates in Solution." A discussion was led by Professor Victor K. LaMer, of Columbia University.

THE title of emeritus has been conferred by Barnard College on Dr. Henry E. Crampton, who recently retired from the chair of zoology.

DR. DOUGLAS JOHNSON, professor of physiography at Columbia University, has been named Newberry professor. He is the fourth head of the department since its foundation in 1866, his predecessors being Professors John Strong Newberry, James Furman Kemp and Charles Peter Berkey.

DR. GRANVILLE A. BENNETT, of the Harvard Medical School, has been appointed professor of pathology and bacteriology at the School of Medicine of the Tulane University of Louisiana.

BRIGADIER GENERAL JAMES STEVENS SIMMONS, A. U. S., director of the Division of Preventive Medicine of the Office of the Surgeon General, U. S. Army, has been appointed lecturer in public health on the staff of the School of Medicine of Yale University.

DR. RUFUS OLDENBURGER, professor of mathematics at the Illinois Institute of Technology, has been

elected a member of the board of directors of the Geographic Society of Chicago.

DR. GEORGE W. HUNTER, III, now on leave from Wesleyan University and serving in the armed forces of the United States, has resigned as assistant professor of biology. Dr. Hunter received a commission as captain in the Sanitary Corps in April, last year. In January he was promoted to the rank of major. Since entering the service, he has been detailed to duty at the Army Medical School, Washington, D. C.

DR. BASSETT MAGUIRE, who joined the staff of the New York Botanical Garden in January as visiting curator, will become curator. He will continue his work on the floras of the Intermountain Region and of Utah and on the taxonomy of the Caryophyllaceae.

LEWIS W. WATERS, vice-president in charge of research and development for General Foods Corporation, New York City, has been appointed to the newly established position of vice-president in charge of scientific relations. Thomas M. Rector, manager of the central laboratories in Hoboken, has been named manager of research and development.

DR. DONALD W. MCKINSTRY, of the department of biochemistry of the Medical School of the West Virginia University, has joined the staff of the Biochemical Research Foundation at Newark, Delaware.

CHARLES F. BOWERS, professor of architectural engineering at Iowa State College, has been commissioned a first lieutenant in the Army Air Forces.

DR. JAMES F. CROW, of the department of zoology of Dartmouth College, has been granted leave of absence to study tropical medicine and parasitology as a fellow on the Markle Foundation, sponsored by the Association of American Medical Colleges. He will complete his work at Tulane University before the beginning of the next regular term in July, at which time he will teach tropical medicine and parasitology in the Dartmouth Medical School in addition to his regular undergraduate courses in genetics and elementary zoology.

DR. DONALD T. RIES, who has been park naturalist at Starved Rock State Park, Utica, Ill., has been granted leave of absence to serve as an entomologist in the Sanitary Corps of the army with the rank of first lieutenant. He has reported for temporary duty pending transfer at Camp Grant, Ill.

DR. A. PARKER has been appointed director of fuel research in the British Department of Scientific and Industrial Research.

DR. SEWALL WRIGHT, Ernest D. Burton distinguished service professor of zoology at the University of Chicago, will deliver from May 6 to May 20 the 1943 spring lectures of the Hitchcock Foundation at the University of California at Berkeley. The general subject of the lectures is "Gene and Organism."

DR. CARL VOEGTLIN, chief of the National Cancer Institute, Bethesda, Md., will deliver the fifth Frank Billings lecture of the Thomas Lewis Gilmer Foundation on "Chemistry of the Carcinogenesis and Tumor Growth" at a meeting of the Institute of Medicine of Chicago to be held at the Palmer House on the evening of May 28.

DR. CHARLES F. KETTERING, of the General Motors Corporation, was the dinner speaker at the two hundred and fifty-fourth meeting of the American Physical Society at the Ohio State University, on April 30 and May 1. The title of his address was "Looking Forward through Research."

PROFESSOR HARRY N. HOLMES, of Oberlin College, president of the American Chemical Society, spoke on April 28 to the section of the society at Iowa State College. The subject of his address was "Strategic Raw Materials and the National Defense."

DR. V. P. SYDENSTRICKER, professor of medicine at the School of Medicine of the University of Georgia, will deliver the eighth and last Harvey Society Lecture of the current series at the New York Academy of Medicine on May 20. He will speak on "Nutrition under Wartime Conditions."

DR. E. D. MERRILL, administrator of the Botanical Collections of Harvard University, delivered on April 19 the annual Sigma Xi lecture at the University of Oklahoma. His subject was "Plants and Civilizations." While at Norman he also conducted a symposium on the work of Rafinesque and gave a popular talk on the history and accomplishments of the Arnold Arboretum for the benefit of the university, the public and the local garden club organizations.

THE three hundred and ninety-seventh meeting of the American Mathematical Society was held at Stanford University on April 24. A session for the reading of contributed papers was held in the morning. By invitation of the program committee, Professor A. E. Taylor, of the University of California at Los Angeles, delivered an address on "Analysis in Complex Banach Spaces." A symposium on Applied Mathematics was held in the afternoon. This was organized by Professor Aristotle D. Michal, of the California Institute of Technology, who was chairman of the symposium. The program consisted of three addresses: "Theory of Suspension Bridges," by Professor S. P. Timoshenko, of Stanford University; "Some Present Non-Linear Problems of the Electrical and Aeronautical Industries," by Dr. E. G. Keller,

of the Lockheed Aircraft Corporation, Burbank, Calif., and "The Limiting Line in Mixed Subsonic and Supersonic Flows of Compressible Fluids," by Dr. Hsue-Shen Tsien, of the California Institute of Technology.

THE Special Libraries Association will meet as part of the second Wartime Conference at the Hotel Pennsylvania, New York, from June 22 to 24. The science-technology group of the association, representing engineering, chemical, rubber, utilities and aeronautical libraries, both institutional and belonging to various firms, will hold its annual meeting at that time.

THE Laboratory of Applied Physiology of Yale University, under the direction of Professor Howard W. Haggard, announces the establishment of a new research unit to be known as the School of Alcohol Studies. This unit will be devoted to social, statistical, educational and juridical studies relating to the problems of alcohol. Professor E. M. Jellinek is director of the school. He will conduct an annual summer session in alcohol education designed for the needs of those engaged in activities in which thorough knowledge of the facts about alcohol problems will be of particular usefulness. The first summer session will be held from July 8 to August 16. A number of fellowships are available. For particulars, address the School of Alcohol Studies, Yale University, New Haven, Conn.

DR. W. W. CHARTERS, of the War Manpower Commission, announces that short summer courses in sanitary engineering are to be given at Alabama Polytechnic Institute, George Washington University, the University of Michigan, the University of Texas, the Polytechnic Institute of Brooklyn, the University of Southern California and Oregon State College.

As reported in *The Times*, London, Sir Andrew Duncan, British Minister of Supply, stated in reply to Major Lyons (Leicester), that the object of the committee set up to report on penicillin was to insure that all available information regarding clinical and chemical trials and methods of production was collected and exchanged, and that everything possible was done to promote the most rapid development. The committee consisted of Arthur Mortimer, Deputy Director of Medical Supplies, Ministry of Supply (*chairman*); and Professor A. Fleming, St. Mary's Hospital; Professor H. W. Florey, School of Pathology, University of Oxford; Professor H. Raistrick, London School of Hygiene; Sir Robert Robinson, the Dyson Perrins Laboratory, University of Oxford; Dr. C. R. Harrington, Medical Research Council; Dr. A. N. Drury, Medical Research Council; Dr. V. D. Allison, Ministry of Health; Professor I. M. Heilbron, University of Cambridge, and Lieutenant-Colonel Sir Russell Wilkinson, military medical adviser, Ministry of Supply, together with representatives of firms engaged in production of penicillin.

DISCUSSION

THE FORMATION OF MOSS PEAT BENEATH TRANSLUCENT PEBBLES IN SEMI-ARID REGIONS OF THE GREAT PLAINS

ON a field trip with the late Dr. F. A. Hayes[1] and Mr. G. A. Avery[2] in the semi-arid Northern Great Plain, in western South Dakota in May, 1941, it was observed that a growth of moss and algae and an accumulation of moss peat, varying from a thin film to about one fourth inch in thickness occur beneath translucent quartz and chalcedony pebbles and small stones which are embedded in the surface of well-drained soils. Such an accumulation was not found beneath opaque pebbles and stones. The discovery provides further evidence that stone fragments on the surface of the soil help to conserve moisture by checking evaporation.

We made a general study of the area in the vicinity where the peat phenomenon was first observed in order to confirm my first impression that the peat occurs only beneath pebbles that freely transmit light. Samples of the moss and peat and of the pebbles under which they were found were collected for further study and for presentation to the Botany and the Conservation and Survey Divisions of the University of Nebraska. During the past year observations of the phenomenon have been extended, by the writer and others, to much of the Northern Great Plains.

The first requisite for the growth of moss and the formation of peat, as already indicated, is the presence of translucent pebbles. These must be in firm contact with, and slightly embedded in the soil and their surfaces must be exposed to sunlight. Short-grass cover or thin stands of grass in semi-arid regions apparently furnish the most favorable habitat for the growth of mosses and for the development of peat. The phenomena gradually becomes less noticeable, under natural conditions, in passing into arid regions on the one hand and into subhumid and humid regions on the other. In arid regions, because of the lack of sufficient moisture to support peat-producing plants,

[1] F. A. Hayes was senior soil scientist, Division of Soil Survey, Bureau of Plant Industry, U. S. Department of Agriculture and professor of soil science, Conservation and Survey Division, University of Nebraska.

[2] G. A. Avery is associate soil technologist, Soil Conservation Service, U. S. Department of Agriculture.

algae replaces mosses. Few observations have as yet been recorded for subhumid and humid regions; but because the more luxuriant vegetation excludes most of the sunlight from the pebbles, cryptogamous plants probably are less abundant.

Further study of the occurrence and the distribution of peat beneath pebbles and of the plants contributing to its formation is indicated. Specific names of the plants have not yet been determined.

The term "pebble peat" is suggested for the phenomenon described. As yet no mention of the phenomenon has been found in the literature.

B. H. WILLIAMS

DIVISION OF SOIL SURVEY,
BUREAU OF PLANT INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE

BIOLOGICAL SPECIFICITY OF FOLIC ACID

NIELSEN and Elvehjem[1] and Martin[2] have demonstrated the counteracting effect of folic acid concentrates on growth inhibition of rats due to succinylsulfathiazole and sulfaguanidine. These findings, indicating synthesis of folic acid by the intestinal bacteria, are in accord with the findings of Mitchell and Isbell[3] on synthesis of this substance by rat intestinal flora.

Recent investigation of folic acid concentrates in our laboratory has indicated that they can not be regarded as biologically pure, unless this fact has been demonstrated. Two significant impurities may be present, namely, xanthopterin and *p*-aminobenzoic acid. The amount of xanthopterin present may be several per cent., even in the most potent preparation yet tested on animals.[1] This preparation, which was furnished by our laboratory to Nielsen and Elvehjem (designated 15,000 times as potent as solublized liver), has since been found to contain also 1 per cent. of *p*-aminobenzoic acid.

Since Totter and Day[4] have found that xanthopterin is able to counteract the effect of succinylsulfathiazole on rats, its presence in folic acid concentrates can not safely be neglected. The amount of *p*-aminobenzoic acid present in the potent preparation referred to above is probably not enough to seriously affect the results, but the absence of significant amounts of *p*-aminobenzoic in many folic acid concentrates can not be assumed.

We wish to make clear that the biological identity of folic acid is not questioned by these findings, since in the microbiological test for folic acid using Strept. lactis R both xanthopterin and *p*-aminobenzoic acid are inactive.

HERSCHEL K. MITCHELL

[1] E. Nielsen and C. A. Elvehjem, *Jour. Biol. Chem.*, 145: 713, 1942.
[2] G. J. Martin, *Proc. Soc. Exp. Biol. and Med.*, 51: 353, 1942.
[3] H. K. Mitchell and E. R. Isbell, Univ. of Texas Publication No. 4237, 125, 1942.
[4] J. R. Totter and P. L. Day, *Jour. Biol. Chem.*, 147: 257, 1943.

THE KILGORE SENATE BILL

IN the April 23rd issue of SCIENCE, Elliott and Grundfest, the latter national secretary of the American Association of Scientific Workers, highly endorsed the Kilgore Senate Bill 702. They believe with the proponents of this bill that research, development and technology in the United States have no unity of purpose or coordination, and are in a highly disorganized state.

As a matter of fact, the very opposite is true, for never in the history of the country have science and technology been so well organized and coordinated as they are to-day. Striking results have been accomplished by the coordination of governmental agencies, universities, privately endowed institutions, and industrial research laboratories. One may state that the scientific, technological and production men of the United States are doing the greatest job ever undertaken in the history of mankind, namely, converting a great country in less than two years from peacetime pursuits to an all-out war effort. It is safe to say that over 95 per cent. of our scientific and technical manpower and facilities are now highly organized and coordinated to the single end of advancing the war effort, despite the many difficulties involved.

Coordination extends not only to efficient use of materials but to effective mobilization of the human element in research. Our scientists are not only carrying on fundamental and exploratory research at a higher tempo than ever before, but also by applied research providing the materials necessary for the successful prosecution of the war.

In the *Journal of Industrial and Engineering Chemistry* (35: 385, 1943) there is a statement on "Scientific Regimentation" as implied by the Kilgore bill, by Walter J. Murphy.

"The very wording of the 'Declaration of Policy' constitutes a direct insult to the scientific minds of this country and is contrary to the actual facts, as any unbiased study will clearly show.

"We do not have 'an unassembled and uncoordinated state of information concerning existing scientific and technical resources'; we do know that there is no lack of 'an adequate appraisal'; the war effort is not suffering because of 'unplanned and improvident training, development, and use of scientific and technical personnel, resources, and facilities in relation to the national need,' with the exception of the policy of drafting badly needed technically trained manpower into the armed forces."

From time to time our attention is directed toward the super-coordination of science, technology and in-

dustry in Germany as if it were a shining light toward which we should direct our footsteps. This very regimentation of science, technology and industry will prove that nation's undoing. By enforcing regimentation Germany has frozen her scientific and technical assets. As a result she will lose the war because she has destroyed the freedom and competitive spirit which is fundamental to research and on which her ultimate survival depends. We should not make the same blunder by enactment of the Kilgore bill.

The passage of Senate Bill 702 to establish the Office of Scientific and Technological Mobilization would be exceedingly detrimental if not disastrous to the war effort. My convictions are based on the following:

Practically every laboratory in the nation is in the service of the government. These laboratories are headed and staffed by specialists in their particular fields, whether in universities, colleges, research foundations, or operated by individuals and corporations. It is unnecessary for the government to take them over as their programs would be disrupted by any change in management.

Scientists and technologists, though primarily individualists, are submerging personalities in cooperative research of the widest scope, intent only with getting the job done as well and as speedily as possible.

To center the myriad researches now going on in one organization would throw the programs out of gear, causing months or perhaps years of delay while adaptation to the new conditions took place, and during this time we could well lose the war.

As one illustration of scientific and industrial cooperation, individual oil companies, vigorous competitors in peacetime, are now working together, disclosing to each other their processes and technique relating to 100-octane aviation gasoline, lubricants, components of synthetic rubber, toluene for T.N.T. and many other materials produced from petroleum. There are no secrets in the oil industry for the duration.

It is suggested that every scientist, technologist and industrialist carefully study Senate Bills 607 and 702.

GUSTAV EGLOFF
PRESIDENT OF THE AMERICAN INSTITUTE OF CHEMISTS

QUOTATIONS

SCIENCE AND THE CENSOR

IN a joint statement the Army and Navy at last acknowledge that "radar" (a radio detecting and ranging device which spots distant enemy aircraft and which helped to thwart the German attempt to reduce Great Britain to submission) has its uses in war. The press may now presumably tell the public of a device which was patented in half a dozen different forms nearly twenty years ago and described at least in principle in official textbooks. The restrictions by which other military and naval inventions are hedged should also be removed so far as common sense and military discretion permit. By this time, for example, our famous Norden bombsight must have fallen into the hands of the enemy. And so with range-finders and other apparatus captured by the Japanese in the Philippines.

For good reasons of their own the British often release information which is cabled to this country, but which, under the prevailing rules, must be suppressed here. A knowing newspaper man could dig it out of the speeches made by Government spokesmen in response to questions asked in the House of Commons or from articles which have appeared in *Nature, Engineering,* and the *Aeroplane* and which have undoubtedly been approved. But if he prepares an article on his findings he is likely to encounter a granite wall in Washington. Can it be that we know better than the British what may or may not be revealed?

This policy of silence is not limited to strictly military and naval technical news. It includes biology and medicine. It has even happened that statistics given by the President and Cabinet officers in public addresses have been suppressed. Yet the most absurd stories of German technical achievements appear, with the result that the Nazis are credited with far more ingenuity than any people can possess.

It is manifest that the British and American officers of censorship are not coordinated as they should be. It is also manifest that our censors either do not know what is technically new and what is not or that their superiors have given orders that have no justification in the light of military necessity. There has been some disposition of late to take the science writers of the press into the confidence of the War Department, as the recent inspection by invitation of some Eastern war plants indicates. The accounts that the reporters published of what they saw must have been heartening to millions of readers. We want more such articles. A policy of secrecy where there are no secrets can not fail to have a depressing effect on morale. Nothing is worse in time of war than rumor. And the only way to counteract rumor is to publish facts well known to enemy scientists and engineers.—*The New York Times.*

SCIENTIFIC BOOKS

HYDRAULICS

Hydraulics. By GEORGE E. RUSSELL. 5th edition. 468 pp. New York: Henry Holt and Company. 1942.

THIS book is the fifth in descent from a first edition published in 1909. Originally intended to serve as a short elementary text for classroom use, it has grown, through successive editions and two rewritings in large part, to the much more ambitious treatment represented by the present edition. The treatment is presented under fifteen chapters, of which ten deal with the more immediate aspects of the properties and behavior of liquids both at rest and in motion in channels with solid boundaries. The remaining five chapters deal with hydraulic machinery, implying the joint movement of liquids (water usually) and solid boundaries; and involving transfers of energy between the two members of the combination—typically, turbines and pumps.

Although the text is mainly devoted to hydraulics in its literal sense, treatment covering other liquids with high viscosity, such as petroleum oils, and also compressible fluids—gases and vapors—is given to an extent sufficient to enable the student to solve the simpler problems involving such fluids, and also to grasp the essential identity of the basic principles of fluid mechanics in its broader aspects. The five chapters on hydraulic machinery are intended to bring the book into step with modern practice.

The treatment in the first ten chapters is clear, well presented and does not call for mathematical preparation, beyond the simplest applications of the calculus. This self-imposed limitation is something of a handicap in the treatment of certain of the topics, but the treatment thus simplified facilitates the introduction of the student to the subject at an earlier date than under a condition of more rigorous and general treatment.

The chapters on hydraulic machinery present a well-organized elementary treatment of the principles involved, both geometrical and dynamic, with numerous illustrations drawn from recent practice in this field.

The text is well illustrated with 248 figures in the text, of which a number, especially in the chapter on hydraulic machinery, are half tones. There are also some 31 tables giving values of coefficients, etc., together with tables of natural trigonometric functions in the appendix. Most of the chapters are followed by an extended collection of problems illustrative of the subject-matter of the chapter, and aggregating 302 for the book as a whole. There are likewise appended to the subject-matter of the various chapters 76 classified bibliographic references. An appendix gives a brief and elementary discussion of the free vortex, and an explanation of the English and Metric systems of measurement.

The topics chosen for treatment are well selected, the arrangement appears logical, the treatment is clear and sound, and altogether the book should be welcomed as a definite contribution to the field of textbook literature of this subject-matter.

W. F. DURAND

HUMAN REPRODUCTION

The Hormones in Human Reproduction. By GEORGE W. CORNER, Director, Department of Embryology, Carnegie Institution of Washington, Baltimore. 265 pp. 24 plates. 32 figs. Princeton: Princeton University Press. 1942. $2.75.

IN 1942 Dr. Corner delivered the Vanuxem Lectures at Princeton. These lectures, delivered to a general audience, covered the very complex and fascinating assignment of hormones of reproduction. In this volume the author has added much to the material he presented in these lectures. The result is a masterpiece. The subject-matter is presented systematically and accurately and yet so simply and clearly that the reader can not help but be infected by the author's youthful enthusiasm. Even those of us who are intimately engaged in various aspects of the field of internal secretions are carried away with enthusiasm over Dr. Corner's skilful narrative of a detective story involving the innumerable facts accumulated during the past century by many inquisitive scientists. From it we can no doubt all learn how to present involved scientific material in an interesting and convincing style to the layman, but many of us will no doubt discover some, to us, new facts as well.

The subject-matter is developed from the historical, developmental and, in part, comparative scientific point of view beginning with the simplest form, but always in simple terms and with excellent photographic and diagrammatic illustrations of the underlying anatomy. In spite of the elementary and simple presentation the reader is not left with the impression that the remarkable control of the cyclic nature of the processes of reproduction in the female have been completely explained.

The historical background for the isolation of estrogens, progesterone and androgens is given in each case, but naturally, the author writes most feelingly in presenting the development of the scientific methods and results obtained in the isolation of the corpus luteum hormone. He frankly admits that he could not "write this chapter in cool detachment" because of his intimate contact with the work. This chapter

is an excellent lesson in hormone detection and isolation. It is full of examples of disappointments, difficulties, cooperative, national and international, give and take attitude and final success and independent confirmation. Dr. Corner also delights in "endocrine arithmetic," as he calls it. As a result he presents some truly astronomical values on the rate of formation and utilization of progesterone.

Laymen, physicists, chemists, biochemists and biologists alike will find this book exceptionally interesting and valuable.

F. C. KOCH

REPORTS

WARTIME ACTIVITIES OF MELLON INSTITUTE, 1942–43

DURING Mellon Institute's fiscal year ended February 28, 1943, the industrial research staff of the organization has been enlarged to 208 fellows and 187 fellowship assistants—a total increase of 40 for the year. These scientists and engineers have been employed on the 97 industrial fellowships in operation. Forty-four chemically trained women are doing capable work in fellowship laboratory investigations, primarily helping key men. The research demands of the war have indeed given rise to a general expansion of the institute's work.

The donors and members of the institute are exerting every effort to assist the armed forces, federal government agencies and American science and technology in this period of stress. A large number of fellowships are giving their full time to pressing problems induced by warfare. All other fellowships irrespective of name or field have direct or indirect contributory parts in the war effort. Many fellows are serving the nation on emergency advisory or research committees or are participating in field studies of wartime value. Constant technical aid is being furnished to the War Production Board, the Rubber Reserve Company, the National Defense Research Committee and the War Metallurgy Committee of the National Academy of Sciences. In consequence silence must be maintained during war regarding the nature, scope and results of most of the institute's industrial research programs. During the fiscal year—March 1, 1942, to March 1, 1943—the institute has expended $1,520,333 in conductng its various pure and applied science projects. These facts are set forth in the thirtieth annual report of the director, Dr. E. R. Weidlein, to the trustees of the institution.

The interest of the institute's department of research in pure chemistry in cinchona alkaloids has naturally led to investigations relating to synthetic anti-malarials. Apart from any socio-economic significance attached to the normal prevalence of malaria —an estimated one third of the population of the world is subjected to this disease—the gravity of the problem of coping with the malady in many military campaigns renders urgent the discovery of more effectual measures of control. Occupation by the Japanese of those regions in the Far East normally producing the bulk of the world's supply of quinine has made it even more imperative that research on synthetic antimalarials b extended. The department is carrying on a program comprehending various series of compounds for appraisal in malaria therapy. These studies involve in part simple heterocyclic nuclei structurally akin to the cinchona alkaloids and also compounds not so related. Certain Guatemalan plants esteemed locally in the treatment of malaria are being investigated chemically and pharmacologically.

In concluding for the time being researches on the cinchona alkaloids a number of ethers of hydroxyethylapocupreine have been prepared for comparison of their chemical and pharmacological properties with the qualities of the corresponding ethers of 6′-(β-thiolethyl) apocupreine. An innovation in building up certain members of the series of polyhydroxyalkyl ethers of apocupreine, and of other phenolic substances, was the use (as alkylating agents) of the monotosyl esters of the poly-isopropylidene acetals of suitable sugar alcohols. One method for the preparation of hydroxyethylapocupreine has been the hydrolysis of the benzyl group from benzyl-oxyethylapocupreine. It is now known that under the same conditions its homolog, α-phenyl-ethoxyethylapocupreine, is completely hydrolyzed to hydroxyethylapocupreine in approximately one sixth the time with consequent diminution of decomposition to a negligible amount of isolation of very pure hydroxyethylapocupreine in practically quantitative yield.

The statistical study of the use of hydroxyethylapocupreine in the clinical treatment of pneumonia has been suspended in order that the stock of this drug on hand may be utilized for antimalarial investigations. During the past year, however, medical collaborators of the department reported that, after three years of comparing pneumococcic pneumonia cases treated with sulfapyridine, sulfathiazole, sulfadiazine and hydroxyethylapocupreine, the percentage mortality with the latter was nearly the same as with the sulfonamides. Moreover, in contrast with the cases in which sulfa drugs were employed, no toxicity was observed under treatment with hydroxyethylapocupreine. The latter has been shown to be efficacious in the treatment of pneumococcic and staphylococcic infections of the eye.

The pharmacopoeial studies during the year have fallen into three classes. First, have been those quests for facts which inevitably come immediately after the end of a revision period, in consequence of complaints that new standards are too drastic or that new tests or assay procedures are inapplicable to certain lines of manufacture. In general, protests of this nature are usually cared for through easy adjustments of testing methods. Secondly, the national emergency has brought two new sets of problems to the attention of the pharmacopoeial committee of revision occasioned by the failure of foreign sources of supply of important drugs and the need for adjustments in the conservation of sucrose and glycerol. Thirdly, the war has stimulated medical research with particular reference to the requirements in the armed forces for the treatment of burns and traumatic wounds. The laboratory in the institute is also assisting in the revision of the "National Formulary" and the "Pharmaceutical Recipe Book."

The investigations pursued in the Western Pennsylvania Hospital, under subsidy of Mellon Institute, have pertained to burns and wound healing, the mode of action of sulfonamides and the prevention of the common cold. In the work on the treatment of burns attention has been focused on certain polysulfide solutions, one objective being to elucidate the biochemical mechanisms that might explain the improved healing, without infection, characterizing the recovery of several hundred clinical burns already reported. Research on the action of sulfonamide compounds has made use of the colon bacillus. More precise knowledge of the rôle of p-aminobenzoic acid is being sought. The project has involved the mathematical analysis of the growth curves of *B. coli* on a suitable synthetic medium. So far the indications are that a chemical factor (possibly of enzymatic nature) normally originating in bacteria is directly or indirectly responsible for the fission of the cells, that the synthesis of this factor is markedly inhibited by sulfonamides, and that, in the presence of p-aminobenzoic acid, it is possible for the production of this factor to occur. The basic findings of the past six years on the effect of large doses of ascorbic acid on the prevention of the common cold are being subjected to a controlled mass clinical test. The results to date support the original thesis that large doses of this vitamin have an antishocking pharmacological effect, which is quite in contrast to its action where given to correct a nutritional deficiency.

Collaborating with the U. S. Public Health Service, Industrial Hygiene Foundation, whose headquarters are at Mellon Institute, and a group of its member companies are carrying forward a study to assist in reducing sick absenteeism in the industries. The foundation has conducted more plant hygiene surveys than in any previous year; these investigations check on the possible existence of health hazards in the workplaces. If hazards are detected, effectual measures are prescribed for their correction. Besides fostering healthful working conditions, the foundation's plant surveys are proving to be increasingly helpful in advancing harmonious labor relations. The introduction of unfamiliar and new chemicals into manufacturing processes, some with little known effects, is demanding ever greater attention to plant hygiene measures. Meanwhile the dermatoses continue to be the most common of all occupational diseases. The foundation is urging the industries to consult with its specialists regarding the procural of basic information of pertinence and the definition of proper protective measures respecting novel chemical products.

The foundation continued to sustain medical and preventive engineering researches in industrial health by grants to The Saranac Laboratory and the University of Pennsylvania. But studies at the latter institution, as well as at the Harvard School of Public Health, have lately been interrupted by the war. The results of researches in roentgenography at the University of Pennsylvania and on magnesium at The Saranac Laboratory have been published. Another investigation at the University of Pennsylvania pertained to industrial exhaust ventilation.

The foundation's seventh annual meeting, held at the institute on November 10 and 11, was attended by more than 500 industrial executives, health specialists and governmental representatives. There were panels on "Fatigue in Wartime Industry—Hours of Work and Rotation of Shifts," on "More Manpower through the Reduction of Absences" and on "Putting Women, Older Men, and Physically Handicapped to Work." It was reported that the use of aluminum dust in the treatment of silicosis appears to be followed by beneficial results in a significant proportion of cases, chiefly in the amelioration of symptoms and in the increased capacity to work. The campaign to promote proper nutrition for war workers, with emphasis on "pack a lunch that packs a punch," has been stressed as never before and promises to accomplish lasting good. There are now 246 company and association members in the foundation, practically all of which are directly engaged in war production and employ between 2 and 3 million workers.

The number of different industrial fellowships in various fields at the institute are as follows: building technology, 4; ceramics, 7; chemical technology, 31; foods, 8; fuels, 2; hygiene, 4; metallurgy, 7; mineral technology, 4; paper, 2; petroleum, 3; plastics, 12; textiles, 10; miscellaneous, 3. It is timely to point out that investigations of 17 fellowships have related wholly or in part, in one way or another, to synthetic rubbers or rubber replacers of diverse kinds and that

70 research staff members have been carrying on this specific work. Ten fellowships began operation during the year: alumina, cellulosic molding, chemical storage, coal products analysis, coke-plant physical technology, molasses technology, nickel, pencil technology, special lubricants and synthetic rubber hygiene. Four other new fellowships will start soon. During 1942–43 ten fellowships concluded their activities: Cotton Research Foundation, dielectrics, ethanol, Gartex, iodine, meat merchandising, oil cleaner, plate glass, powder metallurgy and special plastics. The Gartex project has been assigned temporarily to the mineral products fellowship; the iodine researches have been intermitted owing to the emergency; the fellowship on powder metallurgy and the multiple industrial fellowship on chain and welding technology have been consolidated with an increase in the personnel.

The investigations on cotton, 1937–43, have left a prominent record of achievement in the field and have opened the door to the future of an important American crop. The research findings have been incorporated in more than fifty publications, including patents. During the past year the multiple fellowship on plate glass technology finished an important study to determine the effect of bomb explosions on glass and other glazing materials. Much information of value in the design, use and protection of windows has been developed and made available to the services and the civilian defense organizations.

During the calendar year 1942, 2 books, 14 bulletins, 33 research papers and 43 other articles appeared from the institute. Twenty-nine United States patents and 17 foreign patents on fellowship inventions were issued. In 1942 investigational results were contributed to the literature by the following fellowships: chemical hygiene, chemical storage, cigaret technology, Cotton Research Foundation, ethanol, food varieties, gas purification, industrial hygiene, meat merchandising, meter, protected metals, Raolin, refractories, tar distillation and tar synthetics. The department of research in pure chemistry also has several papers to its credit during the past year. *Nutritional Observatory,* a quarterly periodical edited by the staff of the multiple fellowship on food varieties, has entered its fourth volume; this journal has a complimentary mailing list of 26,450.

W. A. HAMOR

MELLON INSTITUTE OF INDUSTRIAL RESEARCH,
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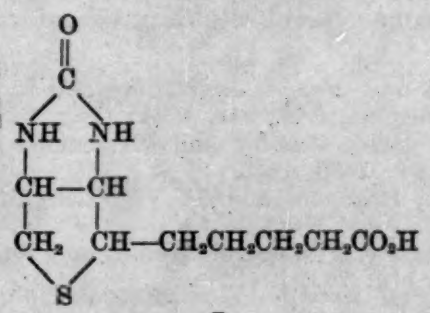
SPECIAL ARTICLES

SYNTHETIC BIOTIN

BIOTIN has been obtained by a total synthesis in this laboratory, and it has been found to be identical with the natural product. This verifies the structure assigned to biotin.

The isolation of biotin as the methyl ester from egg yolk[1] and vitamin H from liver[2] has been described, and the identity of vitamin H and coenzyme R with biotin has been established.[3]

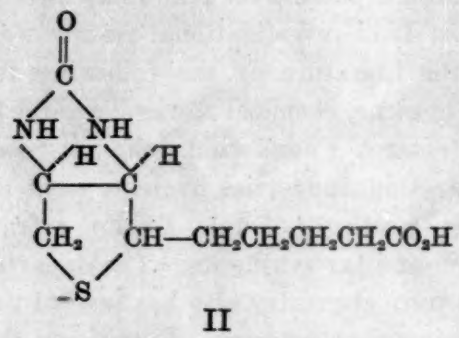
Results of chemical structure investigations in Europe[4] and in this country[5] gave evidence for a carboxylic acid containing a cyclic urea structure and sulfur in a thioether linkage. Further work in this country,[5, 6, 7] showed biotin to consist of a five-membered urea ring fused to a five-membered cyclic thioether having a normal valeric acid side chain. The essential evidence for the five-membered urea ring in biotin was obtained by hydrolysis to a diamine, which gave a dibenzoquinoxaline derivative and which was reconverted quantitatively to biotin by treatment with phosgene.[5] The essential evidence for the ring containing sulfur and having the side chain was furnished by oxidation of the diamine to adipic acid,[5] by the degradation of biotin to desthiobiotin by hydrogenolysis[6] and by degradation to thiophene valeric acid through a modified Hofmann reaction.[7] The structures of the last two compounds were proved by syntheses involving conventional reactions. Barring molecular rearrangements or other obscure reactions during the degradations, these results justified the conclusion drawn by du Vigneaud and collaborators[6, 7] that biotin has Structure I.



I

[1] Kögl and Tönnis, *Zeits. physiol. Chem.*, 242: 43, 1936.
[2] du Vigneaud, Hofmann, Melville and György, *Jour. Biol. Chem.*, 140: 643, 1941.
[3] György, Melville, Burk and du Vigneaud, SCIENCE, 91: 243, 1940; du Vigneaud, Melville, György and Rose, *ibid.*, 92: 62, 1940; György, Rose, Hofmann, Melville and du Vigneaud, *ibid.*, 92: 609, 1940.
[4] Kögl and Pons, *Zeits. physiol. Chem.*, 269: 61, 1941; Kögl and deMan, *ibid.*, 269: 81, 1941; Kögl, Erxleben and Verbeek, *ibid.*, 276: 63, 1942.
[5] Refer to review papers by du Vigneaud (SCIENCE, 96: 455, 1942), and Hofmann ("Advances in Enzymology," Vol. 3, p. 289, 1943. Interscience Publishers, Inc., New York).
[6] du Vigneaud, Melville, Folkers, Wolf, Mozingo, Keresztesy and Harris, *Jour. Biol. Chem.*, 146: 475, 1942.
[7] Melville, Moyer, Hofmann and du Vigneaud, *ibid.*, 146: 487, 1942.

This structure possesses three different asymmetric carbon atoms which normally indicates eight optical isomers or four racemic modifications. However, it is believed from examination of models and reference to the literature[8,9] that two five-membered saturated heterocyclic nuclei fused in this manner can exist only in *cis* forms, as in Structure II.



II

trans Forms of the fused nuclei appear to involve strain which precludes their existence. Apparently, the synthesis of only one compound in which two five-membered rings fused in a *trans* manner through two adjacent atoms has been achieved, namely, *trans*-β-bicyclooctanone,[8] and this is carbocyclic. On this basis, only four isomers existing in two racemic modifications are indicated, and presumably biotin, which is optically active and optically stable,[10] is one of the four.

Any method of synthesis, therefore, has to take these factors into consideration. This we have done. Although the details of procuring best yields of desired intermediates, methods of resolution and other stereochemical problems, etc., are not completely worked out to our satisfaction for a detailed publication as a journal article, we wish to record at this time a comparison of our synthetic product with natural biotin. Synthetic biotin melts at 230–231°, which agrees with the recorded melting point,[11] and is identical with that of a specimen of natural biotin isolated by Dr. J. C. Keresztesy and kindly supplied by him. There is no depression of the melting point of a mixture. The rotation of the synthetic product, $(\alpha)^{25}_D + 90.7°$ (C = 2.0, N/10 sodium hydroxide solution) is in agreement also with that of the natural product, $(\alpha)^{25}_D + 91.4°$ determined here, and, $(\alpha)^{22}_D + 92°$, published[10] previously. The synthetic biotin crystallizes from water in long colorless needles and shows the same general solubility behavior as natural biotin. Its analysis follows: Calcd. for $C_{10}H_{16}N_2O_3S$: C, 49.16; H, 6.60; N, 11.46. Found: C, 49.12; H, 6.47; N, 11.23.

The authors wish to acknowledge the cooperation of Messrs. Glen E. Arth, Robert C. Anderson, Nelson R. Easton and Andrew N. Wilson, and Dr. Dorothea Heyl on the synthesis.

Results of assays on synthetic biotin, determined by Dr. J. L. Stokes, of the microbiology group, with *Lactobacillus arabinosus* No. 17–5 using a described medium,[12] modified to contain nicotinic acid but no biotin, shows that it has a biological activity equal to that of the natural biotin used as a standard.

Bioassays conducted by Dr. G. A. Emerson and Dr. W. H. Ott in the Merck Institute for Therapeutic Research with rats and chicks in which biotin deficiency had been induced by the feeding of egg-white-containing diets demonstrates the fact that the synthetic biotin produces a physiological response identical to that of natural biotin.

The results of the comparison of synthetic with natural biotin establishes their identity and, of course, proves unequivocally the assigned structure[6,7] of biotin.

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PERSISTENCE OF YELLOW FEVER VIRUS IN THE BRAINS OF MONKEYS IMMUNIZED BY CEREBRAL INOCULATION[1]

PERSISTENCE of virus in the body of the host after infection, despite a refractory state to reinfection from without, has been shown to occur in the case of a number of the viruses, and it has been suggested that lasting specific immunity following some virus diseases depends on this persistence. Psittacosis[2] and salivary gland virus infection of guinea pigs[3] are classic examples of diseases in which such conditions have been encountered. Recovery of virus from the

[8] Linstead and Meade, *Jour. Chem. Soc.*, 935, 1934; Cook and Linstead, *ibid.*, 946, 1934; *ibid.*, 956, 1934.

[9] Grigsby, Hind, Chanley and Westheimer, *Jour. Am. Chem. Soc.*, 64: 2606, 1942.

[10] Melville, Hofmann and du Vigneaud, SCIENCE, 94: 308, 1941.

[11] du Vigneaud, Hofmann, Melville and Rachele, *Jour. Biol. Chem.*, 140: 763, 1941.

[12] Snell and Wright, *ibid.*, 139: 675, 1941.

[1] From the Laboratory of the Yellow Fever Research Service, Rio de Janeiro, Brazil. The studies reported in this paper were carried out in the Rio de Janeiro laboratory of the *Serviço de Estudos e Pesquisas sobre a Febre Amarela* (Yellow Fever Research Service) which is maintained jointly by the Ministry of Education and Health of Brazil and the International Health Division of The Rockefeller Foundation.

[2] K. F. Meyer and B. Eddie, *Proc. Soc. Exp. Biol. and Med.*, 30: 483, 1933.

[3] R. Cole and A. G. Kuttner, *Jour. Exp. Med.*, 44: 855, 1926.

brains of animals long after they had been inoculated and found to be refractory to reinoculation has been reported in encephalomyelitis of mice by Theiler,[4] and by Perdrau[5] in rabbits immunized with herpes virus.

Yellow fever vaccine is prepared in this laboratory with active attenuated virus, "17D" strain.[6,7] As a routine control procedure a sample of each lot of vaccine is inoculated into a rhesus monkey by the intracerebral route. Animals so inoculated occasionally show symptoms of central nervous system involvement such as paralysis and muscular incoordinations; even fatal encephalitis has been recorded, though rarely. Usually, however, as in the case of the animals comprising the present study group, the reaction observed is limited to a fever of short duration followed by recovery. Mouse protection tests performed with their blood serum collected thirty days after inoculation show specific neutralizing antibodies.[8]

Attempts were made to recover virus from the brains of some of these monkeys two to five months after inoculation. Three such animals died 63, 93 and 159 days after inoculation, apparently because of generalized tuberculosis. Intracerebral inoculation of mice with suspensions of brain material from these monkeys revealed the presence of an infectious agent capable of producing encephalitis in mice. Strains isolated from all three monkeys were identified immunologically as yellow fever virus. Although the virus in the original brain material was not titrated, a correlation between the period of its persistence and its concentration in the brain is suggested by the study of the mortality and the period of incubation of the inoculated mice. All of them were dead by the ninth and by the thirteenth days, respectively, following inoculation with material from the monkeys which died after sixty-three and ninety-three days. Brain material from the animal dying after 159 days, however, contained only sufficient active virus to produce encephalitis in three of the twelve mice inoculated. These were sacrificed for sub-inoculations shortly after becoming sick on from the eleventh to the thirteenth day.

No virus was recovered from the brains of five additional monkeys which were sacrificed approximately 100 days after inoculation.

An attempt was made in two monkeys, which had been inoculated with 17D virus 161 and 170 days previously, to localize the possibly persisting virus by injecting starch solution intracerebrally 10 days before killing the animals. No virus was isolated from either animal.

The possibility that the tubercle bacillus may play some role in unmasking a latent virus is suggested by the fact, already mentioned, that all three monkeys from which virus was recovered had died in the last stages of generalized tuberculosis.

H. A. PENNA
A. BITTENCOURT

[4] M. Theiler, *Jour. Exp. Med.*, 65: 705, 1937.
[5] J. R. Perdrau, *Jour. Path. and Bact.*, 47: 447, 1938.
[6] M. Theiler and H. H. Smith, *Jour. Exp. Med.*, 65: 767, 1937.
[7] H. H. Smith, H. A. Penna and A. Paoliello, *Am. Jour. Trop. Med.*, 18: 437, 1938.
[8] J. P. Fox, *Jour. Exp. Med.* In press.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

NEW METHOD OF DETERMINATION OF THE CHOLINE-ESTERASE ACTIVITY

CHEMICAL methods to determine the activity of choline-esterase are based on measuring the quantity of acetic acid split off from acetylcholine by the enzyme. The manometric determination[1] of carbon dioxide is commonly used. In an alternate procedure the liberated acetic acid is titrated[2] directly with N/100 NaOH. The acetic acid has been determined also by the nephelometric as well as by the electrometric technique. We considered it worth while to compare the results obtained by the manometric and titration methods. The titration was modified as follows: 1–2 cc of human serum were diluted in a wide test-tube with distilled water to give 9 cc. Three drops of phenolphthalein were added and then N/100 NaOH until the solution turned to light red. Thereupon 1 cc of an acetylcholine solution (1:20) was introduced and the tube placed in a thermostat (38° C) for 20 minutes. The liberated acetic acid was then quickly titrated with N/100 NaOH. In comparing the above methods, human serum was used as the carrier of the choline-esterase, and the determinations were carried out simultaneously.

The results were in qualitative agreement when either undialized or dialized blood-serum was used. The same was the case when Prostigmin "Roche" was injected or taken orally before the blood-serum was obtained. Contrary to this, the results differed remarkably when a calcium chloride solution was added to the blood-serum. In the manometric method the calcium chloride appeared to exert a strong inhibitory effect on the choline-esterase, whereas in the titration method no influence of the calcium chloride was observed. Since the Ringer solution used in the manometric procedure contains calcium chloride, the following checks were carried out:

[1] R. Ammon, *Arch. ges. Physiol.*, 233: 468, 1933.
[2] Stedman, Stedman and White, *Biochem Jour.*, 27: 1055, 1933, modified by Hall and Lucas, *Jour. of Pharmacol.*, 59: 34, 1937.

	cmm CO_2 liberated in 1 hour
Serum + Ringer solution + Acetylcholine	250
Serum + $NaHCO_3$ + Acetylcholine	325
Serum + Ringer solution + Acetylcholine + $CaCl_2$ (1/500 molar)	146
Serum + $NaHCO_3$ + Acetylcholine + $CaCl_2$ (1/500 molar)	234

It appears that the addition of calcium chloride prevents some of the carbon dioxide from leaving the solution. To prove, that the smaller amount of CO_2 found in the presence of calcium chloride was not due to an inhibitory effect of calcium chloride upon the choline-esterase, but to a methodical error, the acetylcholine was replaced by acetic acid in some determinations:

	cmm CO_2 liberated in 15 minutes
Serum + $NaHCO_3$ + N/100 acetic acid	129
Serum + $NaHCO_3$ + N/100 acetic acid + 0,1 cc $CaCl_2$ molar	120
Serum + $NaHCO_3$ + N/100 acetic acid + 0,2 cc $CaCl_2$ molar	95
Serum + $NaHCO_3$ + N/100 acetic acid + 0,2 cc $CaCl_2$ 1/100 molar	127
Serum + $NaHCO_3$ + N/100 acetic acid + 0,2 cc $CaCl_2$ 1/1000 molar	125

It follows from the above experiments that the titration procedure gives more reliable results, but it has the disadvantage that it can only be used in clear and almost colorless solutions.

Since the manometric method requires a Warburg apparatus we attempted to develop a more rapid procedure for the determination of the activity of cholinesterase in colored solutions. The following was found to be satisfactory: The serum, a $NaHCO_3$ solution and the acetylcholine solution were placed in the outer chamber of a Conway-jar[3] and a N/10 $Ba(OH)_2$-solution in the inner part. The total $Ba(OH)_2$ solution, or 0,5 cc was taken out 40 minutes after the Conway-jar was covered with the glass lid, and the quantity of unreacted $Ba(OH)_2$ was titrated with N/100 acetic acid. The values were satisfactory and in agreement with the results obtained by the titrimetric method mentioned above.

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CHEMICAL STUDIES ON CRYSTALLINE BARIUM ACID HEPARINATE

WE have obtained analytical data for the crystalline barium acid salt of heparin (barium acid heparinate) in comparison with those obtained for the neutral and acid salts of mucoitinsulfuric acid and chondroitinsulfuric acid. The following molar ratio was found for barium acid heparinate. Anhydrohexosamine : anhydrohexuronic acid : SO_3 : Ba = 2.0 : 1.9 : 6.0 : 3.0. Further, N : S : Ba = 2 : 6 : 3. Thus all barium is attached to ester sulfate and the carboxyl group of the uronic acid component is free. Summation (89 per cent.) of the above data, in comparison with the high summation (96 per cent.) obtained for the neutral sodium salt of chondroitinsulfuric acid, does not exclude the possible presence of another constituent. *d*-Glucosamine was identified (as *d*-glucosamine hydrochloride) in the hydrolyzate of the crystalline barium acid heparinate. Sodium heparinate (purified through the crystalline barium acid salt) consumes one mole (per 1,200 equivalent weight) of periodic acid.

The amino group of the *d*-glucosamine component of barium acid heparinate is not acetylated and is not free. Barium acid heparinate loses its anticoagulant potency on repeated crystallization from warm, dilute acetic acid. This change is accompanied by the appearance of a free amino group in the molecule, no sulfate is lost and the material is still stained with toluidine blue. Thus neither sulfate content nor toluidine blue staining power are true criteria of heparin activity.

Crystalline barium acid heparinate is also biologically inactivated by prolonged drying at elevated temperatures and by treatment ("Roche heparin" used in this experiment) with weakly ammoniacal hydrogen peroxide, the latter reaction resulting in appreciable sulfate loss.

Full details will be communicated at a later date.

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[3] E. J. Conway, "Micro-Diffusion Analysis and Volumetric Error."

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